

Patent Claims

1. The use of a thermal barrier coating (7) for a steam turbine (300, 303),
which comprises one or more housings (34, 37, 334, 335, 366, 367),
for at least partially or completely adapting different thermal deformation properties of the housing(s) (34, 37, 334, 335, 366, 367) to one another,
in particular between room temperature and operating temperature, and
the housing (34, 37, 334, 335, 366, 367) being exposed to a temperature difference,
in particular of at least 200°C,
produced by a higher temperature on one side (336) of the housing (34, 37, 334, 335, 366, 367) and a lower temperature on the other side (337) of the housing (34, 37, 334, 335, 366, 367),
the thermal barrier coating (7) being applied to the side (336) of the housing (34, 37, 334, 335, 366, 367) which is at the higher temperature.

2. The use of a thermal barrier coating (7) for a steam turbine (300, 303),
which has one or more housings (366, 367) of a blading region,
for reducing radial clearances in the steam turbine (300, 303),
the thermal barrier coating (7) being present on the housing
(366, 367) of the blading region, and/or
the thermal barrier coating (7) being present on a turbine
blade or vane (342, 354, 357).

3. The use of a thermal barrier coating as claimed in claim 1
or 2,
characterized

in that the thermal barrier coating (7) is used for a housing
(34, 334, 335),
which adjoins another housing (37, 366, 367), and
in that the deformation properties of the housing (34, 334,
335) are adapted,
in particular made more uniform,
with respect to the adjoining housing (37, 366, 367).

4. The use of the thermal barrier coating as claimed in claim
1,
characterized

in that the thermal barrier coating (7) is used for a housing
(335) of a steam inflow region (333) of a steam turbine (300,
303),
which adjoins at least one housing (366, 367) of a blading
region, and
in that the deformation properties of the housing (335) of the
steam inflow region (333) are adapted to the deformation
properties of the adjoining housing (366, 367) of the blading
region.

5. The use of a thermal barrier coating as claimed in claim 1,

characterized in that

the thermal barrier coating (7) is used for at least one housing (34, 37) of a valve (31).

6. The use of a thermal barrier coating as claimed in claims 1 to 5,

characterized

in that the thermal barrier coating (7) is used for a housing (34, 37, 335, 366, 367),

which comprises a substrate (4) and a thermal barrier coating (7), and

in that the substrate (4) consists of an iron-base, nickel-base or cobalt-base alloy.

7. The use of a thermal barrier coating as claimed in claims 1 to 6,

which (7) at least partially,

in particular completely comprises zirconium oxide (ZrO_2).

8. The use of a thermal barrier coating as claimed in claims 1 to 7,

which (7) at least partially,

in particular completely comprises titanium oxide (TiO_2).

9. The use of a thermal barrier coating as claimed in claim 1, 2, 7 or 8, characterized in that

the thermal barrier coating (7) is used for a housing (34, 37, 335, 366, 367),
an intermediate protective layer (10),
in particular an MCrAlX layer,
where M is at least one element selected from the group consisting of nickel, cobalt and/or in particular iron
and X is yttrium and/or silicon and/or at least one rare earth element,
is present beneath the thermal barrier coating (7) of the housing (34, 37, 335, 366, 367).

10. The use of a thermal barrier coating as claimed in claim 1, characterized in that

the higher temperature is at least 450°C, in particular up to 800°C.

11. The use of a thermal barrier coating as claimed in claim 9, characterized in that

a material consisting of
11.5 wt% - 20 wt%, in particular 12.5 wt% - 15 wt% chromium,
0.3 wt% - 1.5 wt%, in particular 0.5 wt% - 1 wt% silicon,
0.0 wt% - 1.0 wt%, in particular 0.1 wt% - 0.5 wt% aluminum,
remainder iron
is used for the intermediate protective layer (10).

12. The use of a thermal barrier coating as claimed in claim 1, 2, 7, 8, 9 or 11, characterized

in that the thermal barrier coating (7) is used for a housing (34, 37, 335, 366, 367), and

in that an erosion-resistant layer (13),
in particular a metallic erosion-resistant layer (13),
is present on the thermal barrier coating (7).

13. The use of a thermal barrier coating as claimed in claim 12, characterized in that

an iron-base, nickel-base, chromium-base or cobalt-base alloy,
in particular NiCr 80/20,
is used as the erosion-resistant layer (13).

14. The use of a thermal barrier coating as claimed in claim 12, characterized in that

an erosion-resistant layer (13)
which has a lower porosity than the thermal barrier coating (7)
is used.

15. The use of a thermal barrier coating as claimed in claim 1, 2, 7, 8 or 14, characterized in that

a thermal barrier coating (7) which is porous is used.

16. The use of a thermal barrier coating as claimed in claim 1, 2, 7, 8, 14 or 15, characterized in that

a thermal barrier coating (7) which has a porosity gradient is used.

17. The use of a thermal barrier coating as claimed in claim 16, characterized in that

a thermal barrier coating (7) whose porosity is highest in an outer region of the thermal barrier coating (7) is used.

18. The use of a thermal barrier coating as claimed in claim 16, characterized in that

a thermal barrier coating (7) whose porosity is lowest in the outer region of the thermal barrier coating (7) is used.

19. The use of a thermal barrier coating as claimed in claim 1 or 2, characterized in that

a thermal barrier coating (7) whose thickness is locally (335, 366, 367) different is used.

20. The use of a thermal barrier coating as claimed in claim 1 or 19,
characterized in that

a thermal barrier coating (7) whose material is locally (335, 366, 367) different is used.

21. The use of a thermal barrier coating as claimed in claim 1, 19 or 20,
characterized in that
the thermal barrier coating (7) is only applied locally in certain regions of the surfaces of housings (34, 37, 334, 335, 366, 367) of a valve (31) or turbine (300, 303).

22. The use of a thermal barrier coating as claimed in claim 1 or 2,
characterized in that

the thermal barrier coating (7) is used only in the steam inflow region (333) of the steam turbine (300, 303).

23. The use of a thermal barrier coating as claimed in claim 1, 19, 20 or 21,
characterized in that

the thermal barrier coating (7) is used in the inflow region (333) and in the housing (366) of the blading region of the steam turbine (300, 303).

24. The use of a thermal barrier coating as claimed in claim 1 or 21,
characterized in that

the thermal barrier coating (7) is used only locally in the housing (366) of the blading region.

25. The use of a thermal barrier coating as claimed in claim 1 or 19,
characterized in that

the thickness of the thermal barrier coating (7) is greater in the housing (335) of the inflow region (333) than in the housing (366) of the blading region.

26. The use of a thermal barrier coating as claimed in claim 1 or 2,
characterized in that

the thermal barrier coating (7) is used for housings (34, 37, 335, 366, 367) that are to be refurbished.

27. The use of a thermal barrier coating as claimed in claim 1 or 2,
characterized in that

the thermal barrier coating (7) is used for a valve (31) or housing (334, 335, 366, 367)
without the maximum working temperature in the steam turbine (300, 303) being increased.

28. The use of a thermal barrier coating as claimed in at least one of claims 15 to 21, 23, 26 or 27 or 30, characterized in that

all the deformation properties of various housings (34, 37, 334, 335, 366, 367) are set by the use of the thermal barrier coating (7),

by virtue of the porosity or the thickness or the material of the thermal barrier coating (7) being locally varied.

29. A steam turbine (300, 303),
which has at least two housings (335, 366, 367),
of which at least one housing (335, 366, 367) has a thermal barrier coating (7),

characterized

in that the thermal barrier coating (7, 8, 9) is present in at least two housings (335, 366, 367),

which in particular axially adjoin one another,

a different thermal barrier action of the thermal barrier coating (7, 8, 9) being present in the housings (335, 366, 367),

in particular by virtue of the fact that the thermal barrier coating (7, 8, 9) has different materials and/or different thicknesses and/or different porosities in the at least two housings (335, 366, 367).

30. The steam turbine as claimed in claim 29,
characterized in that

the thermal barrier coating (7) is arranged in the housing (335) of the inflow region (333).

31. The steam turbine as claimed in claim 29 or 30,
characterized in that

the thermal barrier coating (7) in operation is exposed to
temperatures of up to at most 800°C,
in particular up to 650°C.